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ABSTRACT

A study was conducted in light of a neo-Piagetian theory of cognitive development to interpret the effect of priming executive schemes for describing relevant features in a referential communication task. Forty-eight 4-year-old children were divided into primed and nonprimed groups and were asked to describe in isolation a black and white photograph of a dog, or a person's facial expression well enough so that the adult listener could pick out the referent from among an array of nonreferent photographs of the same stimulus set. If the speaker's spontaneous initial encoding was not adequate for distinguishing the referent from the nonreferent array, two forms of feedback were provided by the listener: (1) non-specific verbal feedback of the form ("I still don't know which one it is. Is there anything else you can tell me about it?") and, if an adequate description was still not given: (2) specific visual contrasts (i.e., nonreferents) that fit the description already provided by the subject but were inconsistent with respect to those relevant features not yet mentioned were provided. The cognitive style field dependence-independence and mental processing capacity were assessed pre-experimentally, as well as the priming effect; vocabulary repertoire was assessed post-experimentally. Differences in communication performance between the two groups were not significant except in complex interactions with sex and stimulus order. Explanation for the relative lack of treatment effect were discussed with respect to a production deficiency and a mediation deficiency. (Author/MP)

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The Effect of Priming on Referential Communication in Four Year Olds

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Running Head: Priming

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Abstract

A study was conducted in light of a neo-Piagetian theory of cognitive development to interpret the effect of priming executive schemes for describing relevant features in a referential communication task. Speakers in the task were 48 four year olds, divided into primed and non-primed groups (counterbalanced for sex) who described photographs of dogs' and people's faces to an adult listener. Feedback of a verbal and visual form was provided. The cognitive style field dependence-independence and mental processing capacity were assessed pre-experimentally, as well as the priming effect; vocabulary repertoire was assessed post-experimentally. Differences in communication performance between the two groups were not significant except in complex interactions with sex and stimulus order. Explanations for the relative lack of treatment effect were discussed with respect to a production deficiency and a mediation deficiency.

The Effect of Priming on Referential Communication in Four Year Olds

It is not clear whether the relatively uninformative messages produced by young children in referential communication tasks (cf. Glucksburg, et al, 1975; Asher & Wigfield, 1979) are due to a production deficiency or a mediation deficiency. In other words, are young children failing to mediate their mental representation of relevant features or are they able to mediate them but simply not realize their relevancy to the communicative situation? Ammon (1979), drawing on Pascual-Leone's Theory of Constructive Operations (Pascual-Leone, 1976; Ammon, 1977; Pascual-Leone, et al, 1979, Ammon, 1979), suggests that younger children's failure to engage in comparison activities in referential communication tasks may be due to a mediation deficiency or other psychological factors. A mediation deficiency is possible if the children lack the appropriate executive plans for directing the use of conventional feature matrices. Other psychological factors relate most directly to the notion of working memory, which in Pascual-Leone's theory is described as mental attentional energy or, simply, M energy. In Pascual-Leone's theory M energy can be utilized to boost learned structures (i.e., structures which Pascual-Leone says emanate from Logical or L learning). These LM structures are highly efficient forms of learning, for rules can be chunked so as to reduce the M demand of a task (Case, 1975).

A less efficient form of learning is content learning or C learning. Realistically this kind of learning is probably more accurately described as "LC learning": as a vocabulary is acquired for describing characteristics of stimuli, the words are organized

into a matrix of conventional features. But LC structures are highly bound by situations of specific context. For generalization to occur from one context to another, a great number of cues would have to be released before the schemes comprising the LC learning are activated. The mobilization of M energy is an obvious aid to gneeralization. But the tendency to mobilize M is determined by the amount of mental energy available, which is largely related to maturation, and such individual differences as cognitive style (cf. Case and Globerson, 1975). Mobilization of maximal M energy is under a subject's "executive control".

In the referential communication game "executive control" refers to understanding the purpose of the task as well as knowing what specific strategies are relevant. In an earlier study, Foorman (1977, Note 1) found that the executive schemes employed by 7 year old children mandated the production of conventional and relatively permanent features of the stimuli being described, in contrast to the relatively indiscriminate features produced by 5 year olds. To answer the question of whether this failure was due to a production deficiency or to a mediation deficiency, the present study was designed with a pre-experimental priming condition. The priming procedure consisted of a series of probes about the relevant features of each stimulus set in the context of the four photographs in the practice item. General Probes sought information about how members of the stimulus set differed from one another; Specific Probes referred to differences in the context of pairs of photographs.

If younger children's failure to engage in comparison activities is a result of a production deficiency, then one would expect the priming procedure to elicit knowledge about the relevant executive strategies. Perhaps General Probes would elicit category names for features such as color or shape, rather than specific values such as "black" or "skinny." Drawing on the theory of contructive operators, these category names would appear to reflect LM learning, whereas specific values would appear to reflect LC learning. The transferability of LM learning from one particular context to another may be the kind of learning required to assume that primed information is transferred to the referential communication task. Even though the task immediately follows the priming procedure, young children may perceive the context as totally different and, therefore, not realize the relevance of their LC learning. In such a situation we can speak of a mediation deficiency. In other words, the children would lack the executive plans for mobilizing sufficient M energy to guarantee transfer.

Method

Subjects

The study involved 48 middle-class English-dominant 4 year olds, half males and half females from five preschools in Davis, California. (Originally the author intended to use 5 and 7 year olds as in a previous study. However, as the school district was threatened by a strike the author chose to use preschoolers instead). The average age was 4;1 at the start of the investigation (with a range of 3;5 to 4;6). Two students -- an undergraduate male in Human Development and a graduate female in Child Development -- served as experimenters. Both administered the

pretest; the female experimenter played the role of listener, while the male experimenter and author divided the role of observer; the female experimenter administered the posttest.

Task Description and Procedure

Pretest - Mental attentional energy (M) and the cognitive style field dependence-independence were assessed by the pretest measures Cucui test (Diaz, 1974) and the Water Level Task (Pascual-Leone and DeAvila, 1971) respectively. The Water Level Task was chosen because of the strong correlation (rho = -.60, $p < .0005$, the sign reflects the negative score, deviation score of WLT) that Pasucal-Leone (1969, Note 2) reported between the Water Level Task and the Children's Embedded Figures Test, a common measure of field dependence-independence. The Cucui Test (Diaz, 1974) was chosen as a measure of mental attentional energy because Case (1975, Note 3) found a correlation of .60 (N = 80) with Backward Digit Span, a subtest of the WISC frequently used to assess M energy (Case and Globerson, 1974). Since 4 year olds do not understand the instructions for the Backward Digit Span, the Cucui test seemed a reasonable substitute. The Cucui test was used to refine the factor age by excluding from the sample any subject whose performance fell outside a specified range for the average number of schemes capable of being coordinated at age four (cf. Pascual-Leone, 1970).

The Cucui test consisted of twenty-six pictures of Mr. Cucui, a potato man. The first six pictures were for practice. In each picture different parts of Mr. Cucui's body were colored. The subject was shown each picture for five seconds and then asked to place on an outline of Mr. Cucui an "X" on the places where Mr. Cucui had been wearing colors. The more spots of colors a subject could remember, the greater the subject's short term memory and, hence, mental processing capacity. The number of colors Mr. Cucui was wearing in test items varied randomly from one to four. There were five items at each of these four levels.

Main test: Communication task. - The goal of the referential communication task was to describe in isolation a black and white photograph of a dog, or person's facial expression well enough that the adult listener could pick out the referent from among an array of nonreferent photographs of the same stimulus set. The task instructions were nearly identical for both sets of stimulus materials. For example, for dogs the instructions were: "Pretend that you lost your dog and you have to go to the dog pound to see if you can get it back. You must tell the dog catcher what it looks like and she will look at the dogs that are in the pound to see if she can find it." If the speaker's spontaneous initial encoding was not adequate for distinguishing the referent from the nonreferent array, two forms of feedback were provided by the listener: 1) Non-specific verbal feedback of the form "I still don't know which one it is. Is there anything else you can tell me about it?" and, if an adequate description was still not given; 2) Specific, visual contrasts (i.e., nonreferents) that fit the description already provided by the subject but were inconsistent with respect to those relevant features not yet mentioned.

In sum, the communication task consisted of two stimulus sets presented in the two possible orderings to groups of subjects who were counterbalanced for grade level and sex. Each stimulus set consisted of six items, the first one being a practice item. The influence of item order was taken into consideration by having two random orders within each stimulus order. Each item involved four photographs in the referential array, the referent and three nonreferents.

In addition to the communication task, half the subjects were randomly assigned to a priming procedure and half to a non-priming procedure (i.e., communication task alone). The priming procedure consisted of a series of probes asked in the context of the four photographs in the practice items of the dogs and faces stimulus sets. The probes were both General and Specific in nature. General Probes asked: "How are people's faces different from one another?" or "How are dog's different from each other?" As soon as General Probes failed to elicit a response, Specific Probes were asked in the context of specific pairs photographs: "How do these two faces differ?" or "How do these two dogs differ?" Specific Probes were asked until the subject failed to respond. The Experimenter then completed the priming procedure with the General Probe "Can you think of any other way that people's faces (dogs) are different from one another?"

Posttest. - The neo-Piagetian construct C learning was operationalized in the posttest measure of vocabulary repertoire. The

posttest revealed the extent of a subject's repertoire of values for specific features by posing questions about the referent photographs of the communication task (e.g., "How does the tail look?"). All subjects were tested on all features listed in the feature matrices (see Scoring and Treatment of Data) so that the spontaneously produced vocabulary from the communication task could be correlated with that produced on demand in the posttest. There was approximately a four-week time lapse between administration of the main test and posttest for a subject.

Scoring and Treatment of Data

Pretest.- Scoring procedures for the Water Level Task were the same as those described by Parkinson (1975, Note 4). Three scores were reported for performance on this task: 1) a score on the horizontal/vertical bottles; 2) a score on the tilted bottles; and 3) a composite score. All three scores were utilized in the data analysis for the subscores helped to explain the relative contributions of maturation and experience to cognitive style.

Scores for the Cueni test were generated in the following manner: One point was assigned if 4 out of 5 times in a level were "passed;" 1/5 of a point was added for any other item scored perfectly.

Communication task.- Audio-tapes of the communication task were transcribed and scored according to several dependent variables. Consideration was given to the adequacy of the speaker's initial description for distinguishing the referent from the nonreferents,

the relevancy of the features mentioned, and the number of steps of listener feedback required before an adequate description was produced. If a speaker's initial description enabled the listener to distinguish the referents from the nonreferents, the description was scored as one adequate initial encoding. For any one subject the potential range of adequate initial encoding within stimulus sets was 0 to 5. If a speaker's initial encoding did not differentiate the referent from the nonreferents, four steps of feedback were available: 1 step of feedback corresponded to non-specific feedback (i.e., "I still don't know which one it is. Is there anything else you can tell me about it?"); 2, 3, and 4 steps of feedback corresponded to specific, visual contrasts. Thus, on any one trial a subject's feedback score could range from 0 to 4. Obviously, if 0 steps of feedback were required, then the subject had an adequate initial encoding.

In addition to the adequacy of an initial encoding, the number of features relevant to the task of distinguishing referent from nonreferents was also scored. The dependent variable for this measure was the number of relevant features mentioned per initial encoding. The scoring criterion for relevant features was determined by a score of 1 for every feature mentioned which was in the relevant matrix for each stimulus set. These matrices were developed through extensive pilot testing and contained such conventional features as: hair color/length and shape of eyes and mouth for Faces; and color, size, orientation, and length/position of ears and tail for Dogs. A feature was considered irrelevant if it was

so universal or so personalized as not to help distinguish the referent from the nonreferents (e.g., "She has a nose" or "This dog looks like my dog"). On any one trial the scores for relevant features ranged from 0 on up.

In addition to the quantification of a subject's communication performance, a qualitative analysis of a speaker's performance was conducted by considering the way in which a speaker encoded features prior to feedback. Two dependent variables were assessed: 1) the proportion of features in the initial encodings belonging to different categories (Functional Categories), e.g., the universal and personalized examples given above and such negative, wholistic, and part-inferential examples as "It doesn't have a collar," "she looks surprised," and "It has a tail like a 'c';" and 2) the frequency with which specific features were mentioned first or second in the initial encoding (Specific Features). By noting these Specific Features it was hoped that a subject's conventional feature matrix might be revealed or the construction of such a matrix observed. This matrix would shed light on the neo-Piagetian construct L learning.

Scoring procedures for the priming treatment consisted of dividing responses to General and Specific Probes into Categories and Values. A Category was a response that named a feature, such as hair color or length of tail. A Value gave the specific attribute of a feature, such as "black" or "short tail." Subjects' scores were then reported in terms of the proportion of the total number of General and Specific Probes that were Categories and Values.

Posttest. - The scoring procedure for relevant features mentioned in the posttest utilized the same relevant feature matrices as were used in the main communication task.

Results

Analysis of Variance Results

Analyses of variance were performed on the variables number of adequate initial encodings, number of relevant features, and number of steps of feedback. Analyses were performed separately for the two stimulus sets since previous work (Foorman, 1977) indicated that subjects tended to describe the dog and faces photographs differently. Faces tended to be described with one wholistic label (e.g., "He looks sad"), while dogs tended to be described with several analytic features ("His fur is black and white and he has a long tail").

Table 1

Examination of ANOVA results in Table 1 reveals that there were no significant main effects for Treatment (Primed versus Non-primed), sex, or stimulus order (Faces/Dogs or Dogs/Faces). There were, however, two significant three-way interactions of these factors for adequate initial encoding for faces ($F(1,40)=5.08$, $p < .03$) and steps of feedback for dogs ($F(1,40)=4.95$, $p < .03$). The means for these dependent variables and the other dependent variables are given in Table 2.

The significant three-way interaction between Treatment, Sex, and Stimulus Order for the dependent variable adequate initial encodings proved insignificant when graphed as two-way interactions within each of the relevant independent variables. However, an important finding was revealed in the significant three-way interaction between Treatment, Sex, and Stimulus Order in the dependent variable steps of feedback for dogs. This finding is portrayed in Figure 1.

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Figure 1

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Figure 1 represents the interactions of Treatment by Sex within the stimulus orders faces-dogs and dogs-faces. Posthoc contrasts, utilizing the Dunn procedure, between primed and non-primed males and primed and non-primed females within each stimulus order revealed a significant difference between primed and non-primed males for the order faces-dogs. In other words, primed males needed significantly less feedback on the dog photographs than non-primed males when photographs of facial expressions were described first. One possible explanation for this stimulus order influence is the effect of practice. That is, the tendency for priming to improve referential communication (i.e., reduce the need for feedback) does not seem to be immediate -- at least in this age group. But practice alone is not a sufficient explanation for the interaction with order, for when faces were in the second

position there was no significant interaction. As mentioned earlier, 5 and 7 year old children encoded the dog and faces photographs quite differently (Foorman, 1977, Note 1). Consequently, it is not surprising that one of the sets -- in this case, faces -- is more effective as a "primer" for the priming condition than the other. The reason that the priming condition reduced need for listener feedback when describing dog photographs in second position for males only is not immediately clear. Primed and non-primed males did not differ significantly in Cucui or cognitive style. One way of approaching this finding is to notice the relatively high performance of the non-primed females. Examination of the means in Table 1 reveal that the non-primed females required less feedback than primed subjects, male or females. Non-primed females also outperformed their male counterparts in adequate initial encodings for faces and dogs. In sum, the superior performance of the non-primed females seemed to eliminate a possible main effect of treatment within stimulus order.

Going back to Table 1, we see several significant Trials effects. Trend analysis revealed the pattern in the dependent variables for faces to be quadratic, whereas the Trials effects for adequate initial encodings and steps of feedback in dogs appear due to the difference between the first trial and the other four. The main point here is that these learning effects had nothing to do with the treatment and were fairly typical of repeated measures designs. That is, as a result of task experience subjects learned during the first few trials of describing faces to produce more relevant features, thereby producing more informative messages and requiring less listener feedback.

The final ANOVA result to be presented is the significant difference between stimulus sets in the analysis of relevant features in the posttest. Table 2 reveals the difference to be due to the greater number of relevant features produced by all subjects on dogs photographs ($F(9,396)=30.69$, $p < .00$). This finding is not surprising in light of the tendency to describe facial expressions wholistically (e.g., "He's sad") instead of analytically as was the tendency with the dogs. The critical point in this analysis of relevant features in the posttest is that primed and non-primed subjects did not differ in their relevant feature repertoire for describing these stimulus sets.

Correlation Results

Intercorrelations between pretest, main test, and posttest measures are presented in Table 3 for the non-primed subjects and Table 4 for the primed subjects. Intercorrelations with the Water

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Insert Tables 3&4

Level Task (broken down into separate scores for horizontal/vertical bottles and tilted bottles and a composite score) are not included in the Tables since there was only one significant correlation of WLT with other measures. This one significant correlation -- Cucui-Tilted (rho = -.47, $p < .01$) -- has been discussed by the author in another publication (Foorman, in press). The intercorrelations in Tables 3 and 4 will be presented first in terms of the communication task and posttest measures, then in terms of the experimental group's priming measures.

Communication Task and Posttest Intercorrelations. The inter-

correlations for the communication task measures can be summarized in the following way (see Tables for explanation of variable names and probability levels):

Measures	Primed	Non-primed
Initenc-Relpost	.63***	.65***
Initenc-Relpost	.42*	.40*
Relfeat-Fdbk	-.77**	-.80***
Relpost-Fdbk	-.35**	-.33
Relfeat-Cucui	.52**	.39*
Fdbk-Cucui	-.50**	-.34
Relpost-Cucui	.52**	.19

At a glance it is apparent that primed and non-primed subjects have similar patterns of intercorrelations for communication task and posttest measures. In short, the larger a subject's vocabulary (i.e., Relpost) the more adequate initial encodings produced and the less feedback required; likewise, the more relevant features produced the more informative the message (i.e., Initenc) and the less feedback required. In addition, the higher a subject's mental attentional energy (i.e., Cucui score), the greater the number of relevant features produced. The one difference between the two treatment groups was that for primed subjects Cucui also correlated significantly with feedback and vocabulary (i.e., Relpost) (rho=-.50, $p < .01$ and rho= .52, $p < .01$ respectively). These correlations were not significant for the non-primed subjects. In short, primed subjects with high-average Cucui scores (above average Cucui scores having been eliminated from the study) had greater vocabulary repertoires and required less listener feedback. But it should be pointed out that these above-average Cucui scorers were not producing significantly more adequate initial encodings.

Priming measures. Intercorrelations between priming measures and Cucui, communication task, and posttest measures were presented

in Table 4. The significant results can be summarized as follows by focusing on the combined scores for categories and values produced in response to General and Specific Probes:

1. The higher the Cucui score, the more values given in response to general probes and specific probes (rho = .50, $p < .01$ and rho = .52, $p < 01$).
2. The more categories given in response to general probes, the more adequate initial encodings produced (rho = .52, $p < 01$).
3. The more values given in response to general probes, the more relevant features produced (rho = .71, $p < .001$).
4. The more values and categories given in response to general probes (rho =-.39, $p < .05$ and rho = -.51, $p < .01$) and values given in response to specific probes (rho = -.52, $p < .01$), the less feedback required. (Due primarily to the dogs stimulus set.)
5. The greater the vocabulary repertoire, the more values given in response to general probes, (rho = .42, $p < .05$).
6. The number of categories given in response to Specific Probes does not correlate with any other measure (and therefore, has not been included in Table 4).

Descriptive Analysis

The results of the analysis of the dependent variables Functional Categories and Specific Features are given in Tables 5 and 6.

Insert Tables 5&6

From Table 5 it is evident that the primed group produced twice as

many Wholistic features as did the non-primed group. This experimental treatment group also produced more Universal features, but fewer Personal features and no Non-responses.

The analysis of Specific Features in Table 6 reveals similar patterns of first and second mentioned features in the initial encodings produced for dogs and faces. When describing dog photographs both groups overwhelmingly chose color as the first or second feature. After color the next most frequent for the primed group were tail position, breed, and information about the legs/feet; for the nonprimed group the next most frequent features after color were size/shape, fur, breed, and tongue/mouth.

When describing faces the feature most frequently mentioned first or second by the primed group was emotion. The next most frequent for this group was hair color, followed by hair length, and eye color. For the non-primed group the two most frequent features were in the exact opposite order: hair color, then emotion, followed by teeth and shape of mouth.

Discussion

The results of this investigation generally lead to the conclusion that that primed group was not performing significantly different from the non-primed group. The primed group was producing more adequate initial encodings, more relevant features, and requiring less feedback than the non-primed group, but the differences were not statistically significant except in complex interactions with the factors of Sex and Stimulus Order. Just how different were the groups on the dependent variables in practical terms? 37% of the primed group's initial descriptions were adequate, compared to 26% for the

non-primed group. In terms of absolute values of mean treatment group performance, primed subjects produced 2.17 relevant features per item and required 1.56 steps of feedback. Non-primed subjects produced 1.73 relevant features per item and required 1.80 steps of feedback. In terms of vocabulary repertoire, both groups were identical: an average of 3.69 features per item was produced across stimulus sets. Therefore, vocabulary alone could not account for the slightly better performance of the primed group in the communication task. There seemed to be a tendency for priming to improve 4 year olds' referential communication performance: more relevant features were produced, more informative messages were produced, and less feedback was required as a result of priming. Also, the primed group produced more Wholistic and more Universal features and less Personalized and less Non-responses than the non-primed group. The greater production of Universal features and less production of Personalized features and Non-responses suggests that priming does facilitate an executive scheme representing the task instructions. This scheme mandates that in the communication task the speaker should describe the referent so that the listener can recognize it from among the alternatives in the nonreferent array. This general "describing scheme" would be likely to reduce Non-responses (e.g., "I don't know") and Personalized features (e.g., "It looks like my dog"), yet increase Universals (e.g., "It has a nose"). Universals are not likely to decrease until specific executive schemes are formed which mandate the production of conventional feature matrices which can differentiate members of a stimulus set.

The increased tendency to use wholistic over analytic encodings

as a result of priming is a rather curious finding that may have resulted from the category responses given to General Probes. That is, when subjects were asked how dogs or people's faces differed from one another they often responded with category names that related to the gestalt of the stimulus set more than to analytic features of the set (cf. Rosch, 1973). For examples, with the faces pictures the name of various emotions were often mentioned -- sad, happy, mad. With dogs the breed names or likeness to a particular breed -- usually German Shepherd -- was often mentioned. Exposure to the nonreferent arrays of the practice items during this priming procedure provided the subjects with clear examples of various emotional expressions and pure breeds of dogs. However the referents in the communication task represented mixtures of emotional expressions and mutts. Therefore, the primed group had an advantage over the control group in that the former had been exposed to prototypical human emotional expressions and purebred dogs. Such exposure seemed to provoke a greater tendency to encode wholistically in the communication task.

Further support for this greater wholistic encoding tendency in the primed group can be seen from results on the dependent variable Specific Features. First and second features mentioned in initial encodings were very similar for the two groups. However, when describing faces the primed group tended to mention emotion first and then hair color, while for the non-primed group the order was reversed. Since emotion is always encoded wholistically this result lends further support to the influence of the priming procedure on the wholistic encoding preference of the primed group.

But why were the overall results of this study not more striking? The most likely possibility has to do with the nature of the priming treatment. In one sense the non-primed group was not totally unprimed. "Non-primed" subjects were somewhat primed by their experience in the first stimulus set. The fact that there were significant Trials effects regardless of treatment groups further supports this notion of learning from task experience.

In addition to the subtle priming stimulated by task experience, the nature of the probes needs to be examined. The priming procedure consisted of a series of General Probes (i.e., "How are dogs'/people's faces different from one another?") and a series of Specific Probes (i.e., "How are these two dogs/people's faces different from one another?") that were successful in eliciting category names and values. Primed subjects demonstrated that they knew how to describe relevant features of the stimulus sets. But when given the opportunity to apply their knowledge in the communication task, their performance was not significantly better than the non-primed group. Why didn't they apply their primed skills? A reasonable explanation is that, in terms of the theory of constructive operators, what was elicited in the priming experience was primarily a result of LC learning not LM learning. In other words, what was primed was all of the conventional vocabulary for talking about dogs and people's faces. What did not appear to be primed for most subjects was the rule which would mandate the production of this relevant vocabulary in a different context

(i.e., the communication task). However, for a few high Cucui scorers the priming procedure did appear to elicit LM learning. These subjects tended to require less feedback in the communication task and to produce a larger vocabulary repertoire in the posttest. High Cucui scorers also tended to produce more values in response to General and Specific Probes. The significance of these correlations is underscored by the restricted range of Cucui scores. That is, only those subjects who performed within the range of typical 4 year old Cucui scores were included in the study. One wonders if those who were eliminated from the study due to above average mental processing capacity would have demonstrated more LM learning and, therefore, produced significant gains in the communication task. Their LM learning would have resulted in the production of more category names during the priming procedure. It would seem that when category names are primed pre-experimentally there would be greater likelihood of seeing in the communication task specific executive schemes mandating the production of conventional features.

In conclusion, 4 year olds' knowledge of how to describe relevant features of two stimulus sets was primed pre-experimentally. The relative lack of transfer of these demonstrated skills to the communication task is evidence of a production deficiency. That is, relevant features were elicited pre-experimentally, yet these same elicited features were not subsequently produced in the communication task. But the reason behind the production deficiency appears to be a mediation deficiency. The primed

4 year olds did not manifest specific executives plans which could mediate these primed features and organize them into conventional feature matrices to be utilized in the communication task. The role of M energy in this mediation process is evident for a few relatively high M processers were able to mobilize available M energy to generalize elicited category names and values to the communication task. For these few high M processors priming "worked" in the sense that in achieving descriptions in the communication task they required less listener feedback.

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TABLE 1
ANOVA Results for Three Dependent Variables and Two Stimulus Sets

Dependent Variable	Stimulus Set	
	Faces	Dogs
Adequate initial encodings	T x S x StimOrd ($F(1,40)=5.08$, $p < .03$) Tr ($F(4,160)=9.79$, $p<.00$)	Tr ($F(4,160=3.33$, $p < .01$)
Relevant features	Tr ($F(4,160)=2.57$, $p<.04$)	
Steps of Feedback	Tr ($F(4,160)=10.22$, $p<.00$) Tr x StimOrd ($F(4,160)=11.99$, $p < .02$)	T x S x StimOrd ($F(1,40)$ 4.95, $p < .03$) Tr ($F(4.160) = 6.03$, $p<.00$)
Posttest	sets ($F_{9,396}$) = 28.55, $p < .00$	

NOTE - T = Treatment group
S = Sex
StimOrd = Stimulus Set
Tr = Trials

TABLE 2

Table of Means for Communication Measures
Broken Down by Treatment, Sex, Stimulus Order, and Trials

Dependent Variable	Treatment Group: Non-primed				Primed			
	M		F		M		F	
	FD	DF	FD	DF	FD	DF	FD	DF
Adequate initial encodings								
Dogs	.20	.27	.33	.20	.53	.30	.33	.20
Faces	.20	.27	.37	.27	.53	.33	.20	.50
Relevant features								
Dogs	1.63	2.17	2.37	1.27	2.67	1.93	2.17	2.17
Faces	1.30	2.10	1.27	1.77	2.43	2.10	1.60	2.33
Steps of Feedback								
Dogs	2.27	1.47	1.23	1.77	1.07	2.11	1.70	1.48
Faces	2.47	1.83	1.57	1.80	1.30	1.88	1.80	1.16
Relevant features in the posttest								
Dogs		3.92				3.92		
Faces		3.47				3.47		

	Trials				
	1	2	3	4	5
Adequate initial encodings					
Dogs	.23	.44	.25	.37	.19
Faces	.19	.14	.60	.37	.35
Relevant Features					
Dogs	1.87	2.08	2.08	2.23	1.96
Faces	1.52	1.85	1.95	2.04	1.94
Steps of Feedback					
Dogs	2.08	1.29	1.60	1.33	1.94
	2.29	1.96	1.04	1.69	1.73

Table 3

Spearman Correlations for Non-primed Subjects

(N=24)

	Cucui	Initenc	Relfeat	Feedback	Relpost
Cucui		.30	.39*	-.34	.19
Initenc			.65**	-.82***	.40*
Relfeat				-.80***	.30
Feedback					-.33
Relpost					

* $p < .05$
** $p < .01$
*** $p < .001$

Note: Initenc = adequate initial encodings

Relfeat = relevant features

Feedback = steps of feedback

Relpost = relevant features in the posttest

TABLE 4
Spearman Correlations for Primed Subjects
(N=24)

	Cucui	Initenc	Relfeat	FdbK	Relpost	PFGC	PFGV	PFSV	PDGC	PDGV	PDSV	CGC	CGV	CSV
Cucui		.25	.52**	-.50**	.52**	-.15	.35	.37*	.00(5)	.48**	.51**	-.04	.50**	.52**
Initenc			.63***	-.84**	.42*	.39*	.23	-.04	.48**	.42*	.37*	.52**	.32	.29
Relfeat				-.77***	.30	.05	.47*	.06	.35*	.69***	.25	.26	.71***	.34
Feedback					-.35*	-.31	-.32	-.15	-.38*	-.61***	-.53**	-.39*	-.51**	-.52**
Relpost						-.06	.39*	.19	-.04	.38*	.37*	.01	.42*	.26
PFGC							.15	-.27	.48**	-.02	-.04	.74***	.07	-.17
PFGV								.17	.25	.35*	.23	.29	.83***	.27
PFSV									-.38*	.15	.48**	-.31	.11	.75***
PDGC										-.15	-.18	.92***	.12	-.24
PDGV											.57**	-.16	.74***	.54**
PDSV												-.19	.38*	.90***
CGC													.12	-.24
CGV														.39*
CSV														

* $p < .05$
** $p < .01$
*** $p < .001$

NOTE: Initenc = adequate initial encodings
Relfeat = relevant
Feedback = steps of feedback
Relpost = relevant features in the posttest
PFGC = (Probes in Faces) General Categories
PFSV = (Probes in Faces) Specific Values
PDGC = (Probes in Dogs) General Categories
PDGV = (Probes in Dogs) General Values
PDSV = (Probes in Dogs) Specific Values
CGC = Combined General Categories
CGV = Combined General Values
CSV = Combined

Table 5

Functional Categories of Initial Encodings

		Wholistic		Part-Inferential		Negative		Mis-Leading		Univer.	Personal			Non-resp.	
		F	D	F	D	F	D	F	D	F	D	F	D	F	D
		60	21	6	7	5	6	2	9	33	43	5	2	0	0
PRIMED	T	81		13		11		11		76		7		0	
	%	15%		2%		2%		2%		12%		1%			
		28	3	2	6	1	0	0	0	29	8	10	16	15	0
NON-PRIMED	T	31		8		1		0		37		26		15	
	%	7%		2%		Less than 1%		0		8%		6%			

Note: Percentages for Wholistics, Part-inferential, Negative, and Misleading functional categories are based on the total number of relevant features: 522 for the primed group, 416 for the non-primed group. Percentages for Universal and Personals. 605 for the primed group; 479 for the non-primed group.

Table 6

Specific Features of Initial Encodings
(i.e., frequency with which features are mentioned first or second)

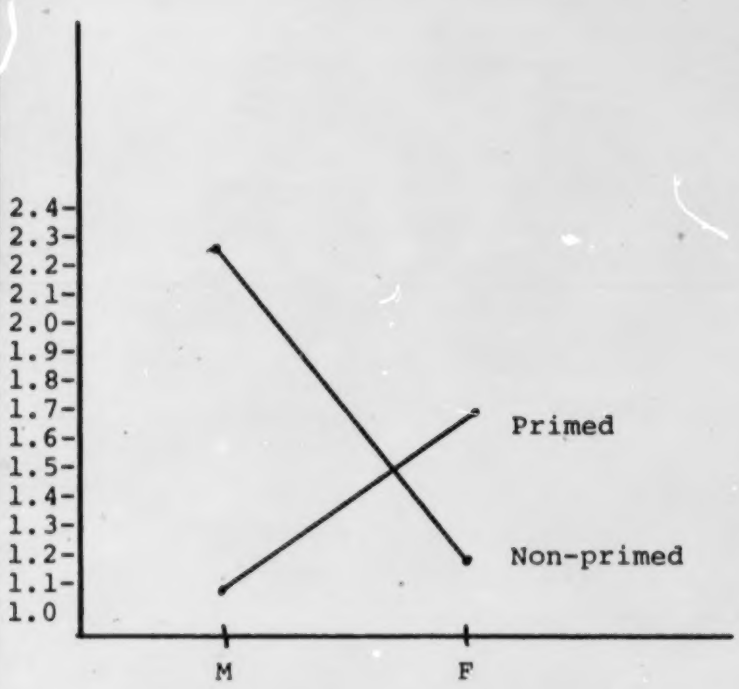
Faces	Sex	Hair				Eyes		Mouth		Eyebrows		Forehead (wrinkles)	Emotion	Clothes	Nose	Face color	Ears	Whiskers	Mustache
		length	color	style	part	color	shape	teeth	shape	color	shape								
Primed	10	14	26	4	1	10	3	8	4	1	0	0	55	2	1	4	1	0	1
Non-Primed	9	15	39	7	0	6	6	11	8	2	0	0	26	1	6	5	0	2	0

Dogs	Color	Orientation		Tail		Ears		Breed (emotion)	Size/Shape	Fur	Collar	Eyes	Legs/Feet	Face color	Nose
		standing	looking	color	position	color	position							(tongue/mouth)	
Primed	76	0	5	6	15	1	3	15	9	4	1	6	13	0	1	1
Non-Primed	57	3	4	4	17	3	7	7	17	10	2	3	3	0	7	3

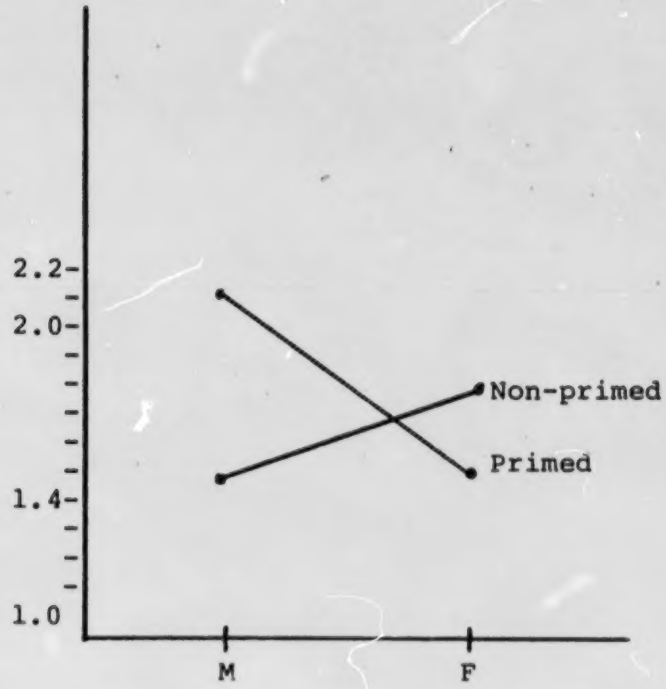
Figure 1

Steps of Feedback in Dogs

(Treatment x Sex Nested Within Stimulus Order)



Within FD



Within DF

32.